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Modelling the impact of radiation changes on the terrestrial carbon sink over the 1900-2000 period

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Solar Radiation is one of the main requirements for plant functioning and any changes in this field are likely to affect plant photosynthesis. For instance, reported changes in surface radiation that lead to increasing diffuse surface irradiance, lead to enhancement in plant photosynthesis (Gu et al. 2003, Niyogi et al. 2004, Yamaso et al. 2006).

Changes in the solar radiation reaching the land surface caused by aerosols emitted from volcanoes and various anthropogenic sources have occurred during the industrial era. Mount Pinatubo in 1991 but also a global dimming followed by global brightening has been observed at several stations during the 1950s -1990s and 1992 -2000s (Wild et al. 2005) respectively. Such changes in total surface radiation are accompanied by changes in direct and diffuse surface solar radiation.

The aim of this study is to estimate the impact of changes in radiation reaching the land surface during the 1900-2000 period on photosynthetic carbon uptake. We use an offline version of the land surface scheme of the Hadley centre model .....(Cox et al. 1998) which has been modified to account for variations of direct and diffuse radiation

on sunlit and shaded canopy photosynthesis. Additionally, we use short wave and photosynthetic active radiation fields simulated by the Hadley center climate model which takes into account the scattering and absorption of light by tropospheric and stratospheric aerosols.

We describe the simulation of the land carbon cycle through the Pinatubo event but also the dimming-brightening period, and diagnose the impact that changes in diffuse radiation had on the atmospheric [CO_2] growth-rate. We will also discuss the implications of these results for the future land carbon-sink, under likely changes in the atmospheric aerosol loading.